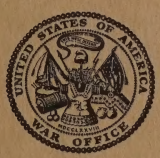
TM 11-2157

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TELEPHONE TEST SET AN/PTM-5



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TECHNICAL MANUAL
No. 11–2157

DEPARTMENT OF THE ARMY
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TELEPHONE TEST SET AN/PTM–5

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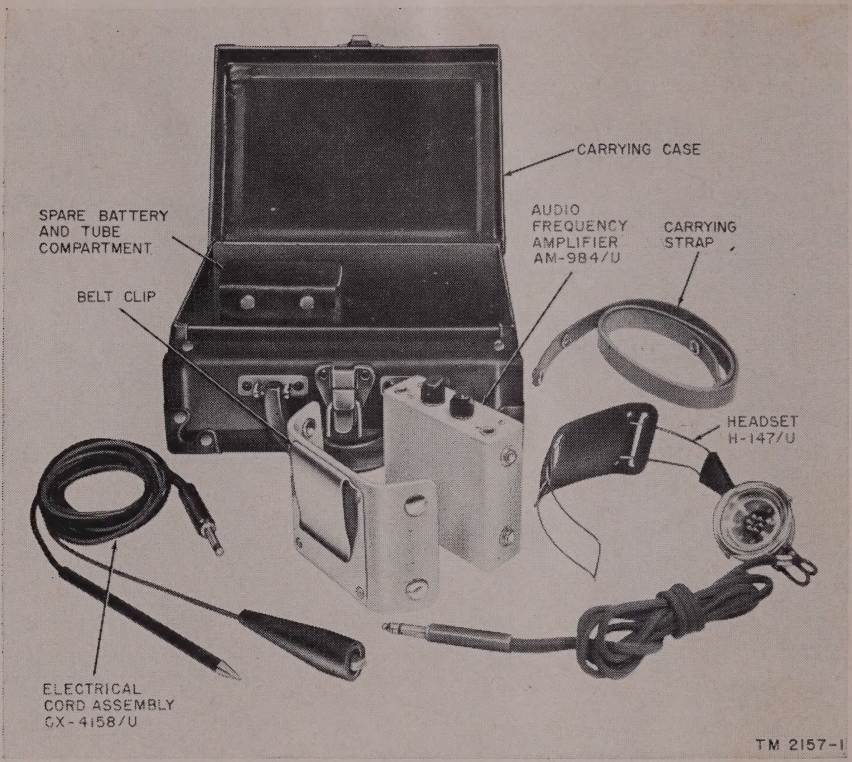


Figure 1. Telephone Test Set AN/PTM–5.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions contain description and information on the installation, operation, maintenance, and repair of Telephone Test Set AN/PTM–5 (fig. 1).

b. Forward comments on this publication directly to Commanding Officer, United States Army Signal Publications Agency, Fort Monmouth, N. J.

c. Whenever official nomenclature is followed by a parenthesis with no number or symbol in the parentheses (□), reference is made to all models of the equipment. Thus, Multimeter TS–352 (□)/U refers to all models of Multimeter TS–352/U and Test Set I–142–(□) refers to all models of Test Set I–142.

2. Forms and Records

a. Unsatisfactory Equipment Reports. Fill out and forward DA Form 468 (Unsatisfactory Equipment Report), to Commanding Officer, United States Army Signal Equipment Support Agency, Fort Monmouth, N. J., as prescribed in AR 700–38.

b. Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment), as prescribed in AR 700–58.

c. Preventive Maintenance Forms (figs. 6 and 7).

(1) Prepare DA Form 11–240 (Operator First Echelon Maintenance Check List for Signal Corps Equipment—Telephone Set), in accordance with instructions on the back of the form.

(2) Prepare DA Form 11–241 (Second and Third Echelon Maintenance Check List for Signal Corps Equipment—Telephone Set), in accordance with instructions on the back of the form.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Telephone Test Set AN/PTM–5 is a portable, lightweight, battery operated cable splicer's test set that will detect and amplify

weak tone signals. The test set is used to identify single leads or pairs in a cable without breaking the individual conductor insulation. It can be used with either a test probe or an exploring coil.

4. Technical Characteristics

Input impedance:
PROBE-COIL switch in PROBE position 2 megohms.
PROBE-COIL switch in COIL position 1,000 ohms.
Power requirements:
1 Battery BA–261/U 22½ volts.
2 Batteries BA–58 or 1 Battery BA–272/U 1½ volts.
Electron tubes One CK533AX (output amplifier.)
Two CK534AK (input amplifier and interstage amplifier).

5. Table of Components

(fig. 1)

Quantity	Component	Depth (in.)	Width (in.)	Height (in.)	Length (in.)	Weight (lb)
1	Audio frequency Amplifier AM–984/U.	4	4	1½		1¼
1	Electrical Cord Assembly CX–4158/U.				84	¼
1	Headset H–147/U	5	7½	3		½
1	Belt clip	3½	7	½		⅜
1	Carrying strap				40	¼
1	Case	9	11¼	5⅜		2⅜
2	Technical manual TM 11–2157.					¼
	Set of running spares Consisting of: 1 Electron tube CK533AX. 1 Electron tube CK534AX.					

6. Description

(fig. 1)

a. Audio Frequency Amplifier AM–984/U. The AM–984/U (amplifier) is contained in a gray metal box. Operating controls are mounted on the plastic front panel. A belt clip can be secured to the amplifier case by snap fasteners on each side of the amplifier case.

b. Electrical Cord Assembly CX–4158/U. The CX–4158/U (test probe) consists of a two-conductor test cord terminated in a switch-

board-type at one end and a test clip and the probe tool at the other end. The probe tool consists of a blunt brass tip fastened to a fiber handle.

c. Headset H–147/U. The H–147/U (test receiver) consists of a telephone receiver mounted on a headband. It is equipped with a two-conductor cord terminated in a switchboard-type plug.

d. Carrying Case. The carrying case is a black fiber case with a hinged cover. A trunk-type latch is used to latch the cover closed and a carrying handle is provided on the front of the carrying case. Straps are provided to secure the components against the rubber cushions inside the carrying case. The separate compartment is for spare parts.

7. Additional Equipment Required

a. The following equipment is not supplied as part of the AN/PTM–5 but is required for all types of operation of the test set.

(1) One Battery BA–261/U (22½ volts).

(2) Two Batteries BA–58 or one Battery BA–272/U (1½ volts).

(3) An audio oscillator with an output frequency of approximately 500 cycles per second (cps) is required as a tone source.

b. When the test set is used with an exploring coil (such as Sig C stock No. 3F4316.2), the following additional equipment is required to connect the exploring coil to the test set.

(1) Cord (Sig C stock No. 3E8000–72.2).

(2) Plug (Federal stock No. 5935–192–4774).

CHAPTER 2
OPERATION

8. Unpacking Equipment
(fig. 2)

a. Packaging Data. The components for Telephone Test Set AN/PTM–5 are individually wrapped and placed inside the carrying case. The carrying case is placed in a corrugated shipping carton. Corrugated cushions are placed around the carrying case to prevent shifting during shipment. The carton is sealed with pressure sensitive tape. The outside dimensions of the packaged test set are 12 inches by 10 inches by 6 inches. Its volume is .4 cubic foot and it weighs 6½ pounds.

b. Removing Contents.

(1) Open the cover of the corrugated shipping carton and fold back the cover flaps.

(2) Remove the envelopes containing the technical manual.

(3) Remove the carrying case from the shipping carton.

(4) Open the carrying case, remove and unwrap the components.

9. Checking Equipment

Check the equipment against the packing list. When no packing list accompanies the equipment, the table of components (par. 5) may be used as a general check to indicate the equipment which *probably* was packed.

10. Telephone Test Set AN/PTM–5, Controls and Jacks
(fig. 3)

The following chart lists the controls and jacks of the test set and the function of each control.

Item	Function
INPUT jack	Connects a probe or exploring coil to the input of the amplifier.
REC jack	Connects amplifier output to the headset.

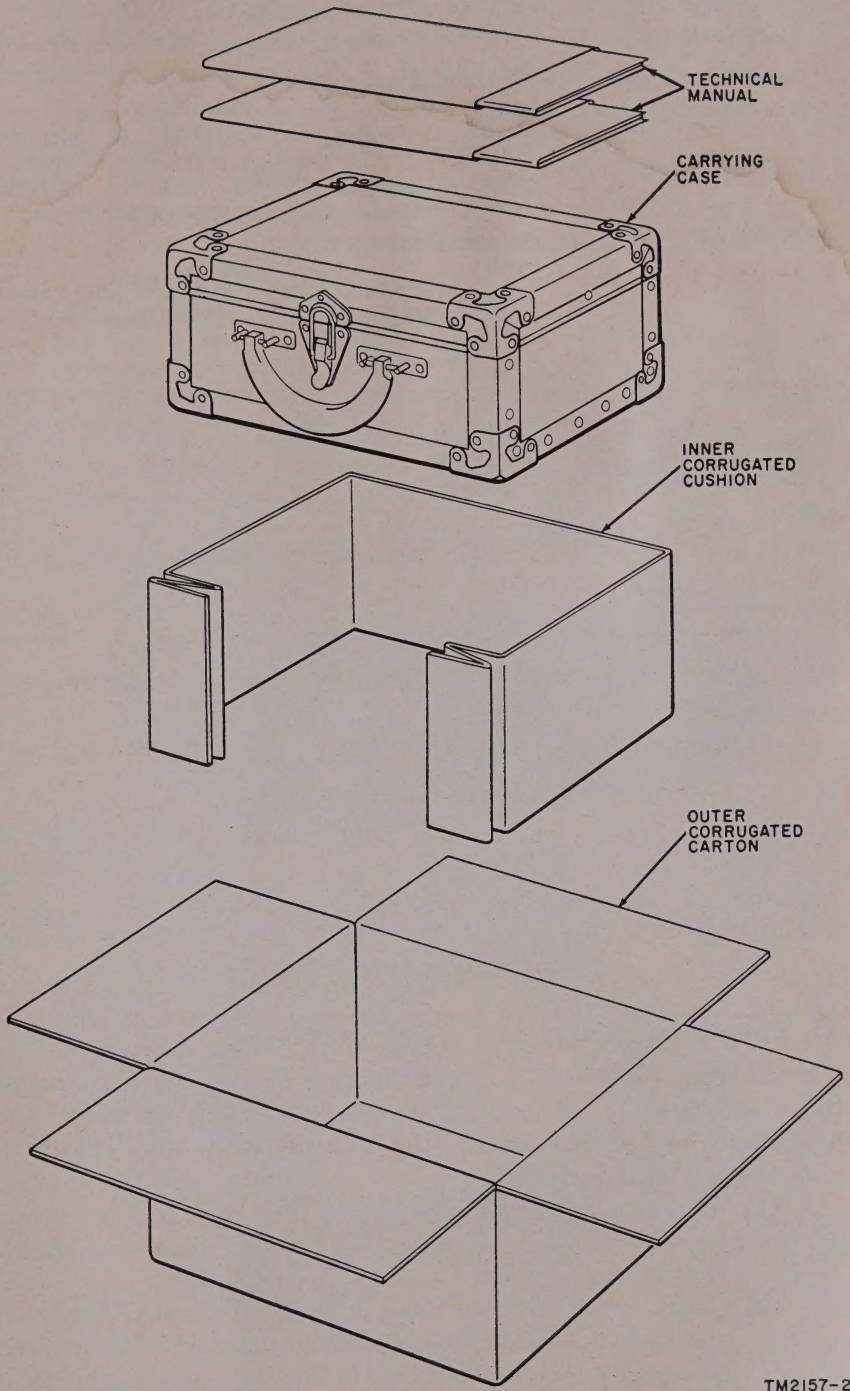


Figure 2. Telephone Test Set AN/PTM–5, packaging diagram.

Item	Function
PROBE-COIL switch	Two-position turn switch: *Position* — *Function* PROBE — Connects INPUT jack to amplifier through a high impedance network. COIL — Connects INPUT jack to amplifier through a low impedance network.
VOL control	Potentiometer type control: *Position* — *Function* 0 — Minimum volume of the amplifier output. 100 — Maximum volume of the amplifier output.

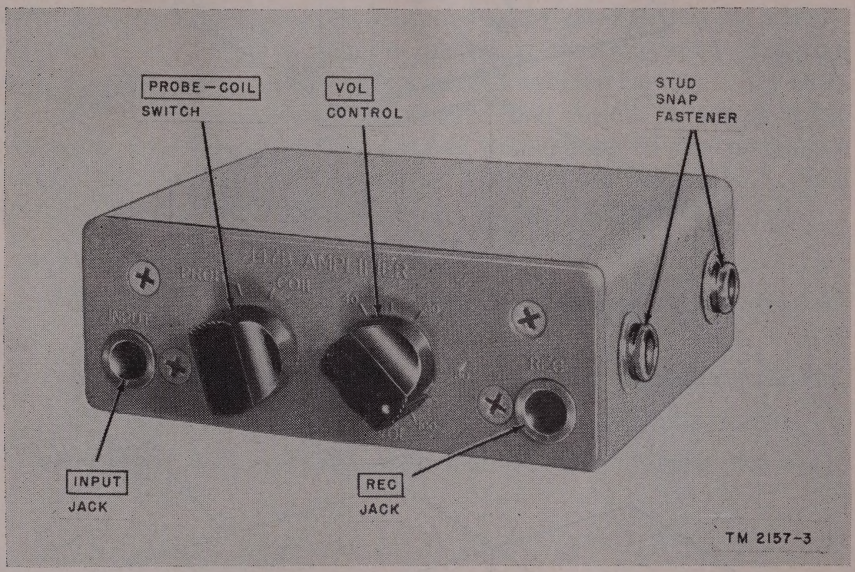


Figure 3. Amplifier, front view.

11. Battery Installation and Operational Check

a. Battery Installation. Turn the lock located on the rear of the amplifier case ¼ turn counterclockwise and withdraw the amplifier from the case. Install the batteries as shown in figure 4.

b. Visual Check of Amplifier.

(1) Inspect all interior components for damage, deterioration, or misalinement which might prevent proper operation of the amplifier.

(2) Check to be sure the tubes (fig. 8) are seated firmly in the sockets. Each tube should be inserted with the red dot positioned to aline with the red dot on the tube socket. The tube clamping bar should clamp the tubes firmly in the sockets.

c. Replacing Amplifier. Slide the amplifier into the case so that the lock and the fastener meet correctly. Fasten the amplifier in the case by turning the lock ¼ turn clockwise.

d. Amplifier Performance Check. Follow the procedure given below to be sure the test set is operating properly.

(1) Turn the PROBE-COIL switch to the PROBE position.
(2) Insert the plug of the probe into the INPUT jack.
(3) Insert the plug of the receiver into the REC jack. This turns the test set on.
(4) Turn the VOL control to 100.
(5) Tap or rub the tip on the probe with your finger. A thumping or scratching sound should be heard in the receiver.

Caution: Remove the receiver plug from the REC jack when the test set is not in use to prevent unnecessary drain on the batteries.

12. Connection of Tone Source

Connect a tone source to the cable in one of the three arrangements, *a* through *c* below, as applicable.

a. Local Cable or Cable Not in Use. Connect the tone source between one wire or a pair and ground (cable sheath) (A, fig. 5).

b. Paired Toll Cable. Connect the tone source between the wires of a pair (B, fig. 5).

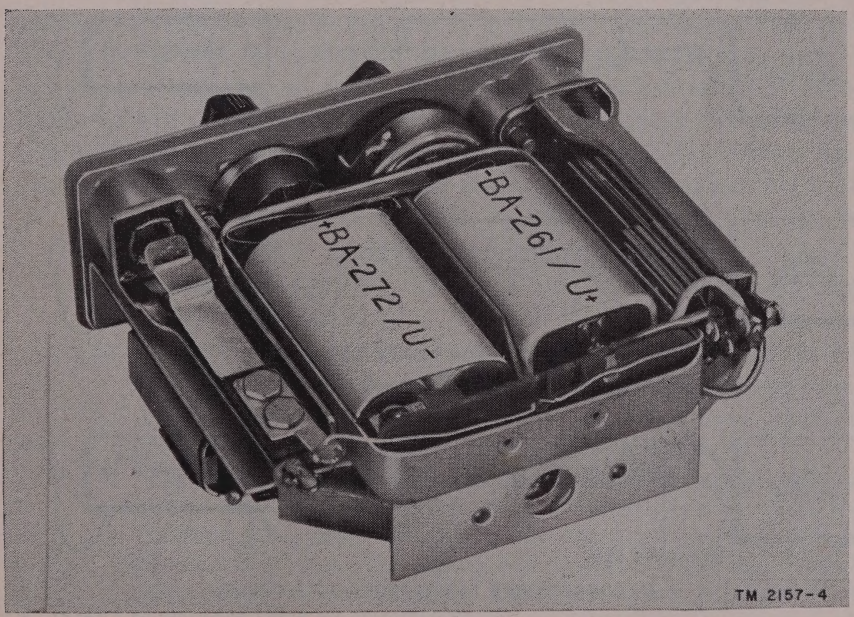


Figure 4. Amplifier with batteries installed.

c. Quadded Cable. Strap the two wires of each pair in the quad together and connect the tone source between the two strapped pairs (C, fig. 5).

13. Arranging Test Set to Carry Amplifier

a. Belt Clip. Snap the leather belt clip to the amplifier case so that when the clip is placed on the belt, the controls face upward.

b. Shoulder Strap. Snap one end of the shoulder strap to one side of the amplifier case. The shoulder strap should be attached to the amplifier case so that the controls face upward when the test set is being carried.

14. Use of Probe to Locate Pairs

a. If a section of the sheath has been removed from the cable, bond the two ends of the cable sheath together to prevent interference in the amplifier.

b. Insert the plug of the probe assembly into the INPUT jack. Connect the test clip to ground (cable sheath).

c. Turn the PROBE-COIL switch to the PROBE position and turn the VOL control to the maximum clockwise position.

d. Insert the plug of the receiver cord into the REC jack.

e. Place the probe tip on the cable pairs at a right angle to the cable. *Do not touch the probe tip with the fingers, and do not allow the tip to make contact with the metallic conductor.*

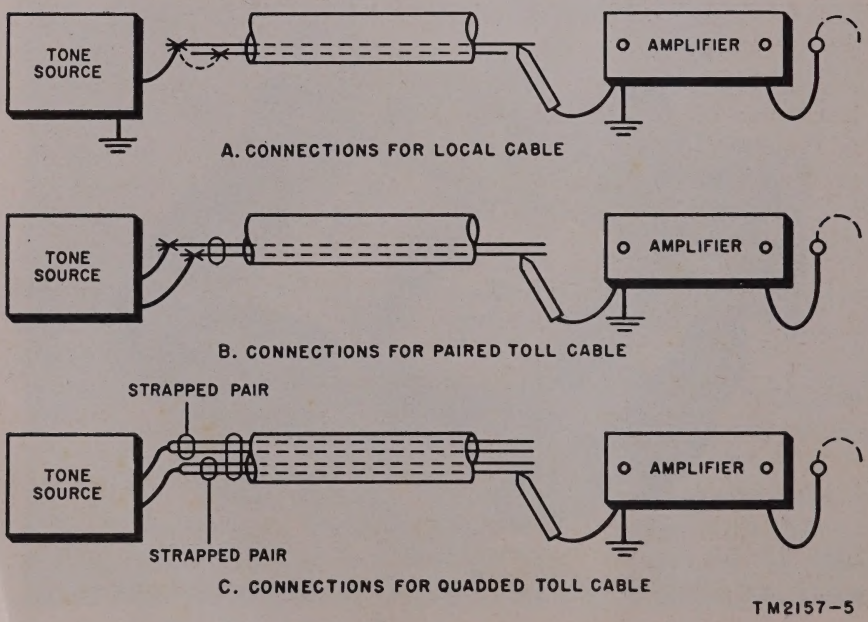


Figure 5. Tone source connections.

f. Move the probe tool tip around the outside of the cable pairs to determine whether the wire to be located is in the outside layer. If the wire is in the outside layer, loud tone should be heard.

g. If the wire is not in the outside layer, push the probe tool into the cable at various points. When the section of cable has been located where the loudest tone is heard, separate the pairs and test them individually.

Note. Some tone may be heard from other wires. If this tone is objectionable, turn the VOL control counterclockwise until the tone on the tone-fed wires can be distinguished from the tone on the unfed wires.

15. Use of Exploring Coil with Telephone Test Set AN/PTM–5

a. Connection of Exploring Coil.

(1) Connect the cord (par. 7*b*) to the coil terminals.
(2) Remove the plug shell from switchboard-type plug (par. 7*b*).
(3) Cut back the fabric insulation about 2 inches.
(4) Strip about $\frac{3}{8}$ inch insulation from each conductor of the cord.
(5) Serve the end of the fabric with heavy thread to prevent fraying.
(6) Screw the cord into the switchboard-type plug and connect the conductors to the terminal screws inside the plug.
(7) Replace the plug shell.

b. Using Exploring Coil With Test Set. The exploring coil is used primarily to locate trouble in a cable. Telephone Test Set AN/PTM–5 may be used with the exploring coil if the tone signal is too weak to be heard when only the exploring coil is being used. Refer to TM 11–372, Lead Sheath Telephone Cable Splicing, for troubleshooting procedures using an exploring coil. Follow the procedure given below to use the test set with an exploring coil.

(1) Operate the PROBE-COIL switch to the COIL position.
(2) Turn the VOL control to the 100 position.
(3) Insert the exploring coil plug into the INPUT jack and insert the receiver plug into the REC jack.
(4) With tone applied to conductors in the cable, place the exploring coil on the cable sheath and listen for the tone. Adjust the VOL control to a satisfactory tone level in the receiver.

Note. For some exploring coils, better operation may be obtained with the PROBE-COIL switch in the PROBE position. Place the exploring coil on the cable sheath near the point where the tone is being applied. Check the operation of the test set with the PROBE-COIL switch in each position. Leave the switch in the position in which the test set operates better.

CHAPTER 3
ORGANIZATIONAL MAINTENANCE

Section I. OPERATOR'S MAINTENANCE

16. Scope of Operator's Maintenance

Operator's (first echelon) maintenance of the test set includes preventive maintenance such as general cleaning and tightening of the equipment (par. 17). The operator will replace the batteries in the test set (par. 18) and will refer all other deficiencies to the organizational maintenance personnel. Tools and materials required by the operator to clean the test set and perform operator's maintenance are listed below:

Lint-free cloth
Plug burnishing paste
Sandpaper No. 0000
Cleaning Compound (Federal stock No. 7930–395–9542)
Neatsfoot oil (Federal stock No. 8030–244–1031)
Friction Tape TL–636/U
Screwdriver TL–360/U
Electrician's knife

17. Operator's Preventive Maintenance

a. DA Form 11–240. DA Form 11–240 (fig. 6) is a preventive maintenance check list to be used by the operator. Items not applicable to Telephone Test Set AN/PTM–5 are lined out in the figure. References in the ITEM block of the figure are to paragraphs that contain additional maintenance information pertinent to the particular item. Instructions for the use of the form appear on the back of the form.

b. Items. The information in this subparagraph is supplementary to DA Form 11–240. The item numbers correspond to the ITEM numbers on the form.

Items	Maintenance procedure
2	Check probe and test receiver assembly plug shells for chipping or cracking.
4	Check belt clip and carrying strap for secure connections to the snap fastener studs on the amplifier.

Items	Maintenance procedure
7	Be sure that the tube clamping bar is firmly in place to hold the tubes in the sockets and to prevent the printed circuit network from shifting position.
16	Wipe the carrying strap and the belt clip with a clean cloth moistened with neatsfoot oil.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
TELEPHONE SET

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: TELEPHONE TEST SET AN/PTM-5
EQUIPMENT SERIAL NO.:

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; Ⓧ Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	INSPECT CORDS FOR KINKS, FRAYING, CUTS, BREAKS. *(Outdoor use).*		✓					
2	INSPECT EXTERIOR CONNECTIONS FOR SNUG FIT AND GOOD CONTACT. *(Outdoor use).* PAR. 17 b		✓					
3	CLEAN CORDS, CASES, ~~HANDSET,~~ AND BATTERY COMPARTMENT OF MOISTURE, DIRT, GRIME, ~~BATTERY ACID,~~ MILDEW, CORROSION. *(Outdoor use).*		Ⓧ					
4	INSPECT FOR SECURE MOUNTING STRAPS. *(Outdoor use).* PAR. 17 b		✓					
5	INSPECT BATTERY COMPARTMENT FOR CORROSION, GOOD BATTERIES, BROKEN OR MISSING SPRINGS, ~~BATTERY ACID. (Local battery use).~~		✓					
6	~~OPERATE THE TELEPHONE AND CHECK FOR PROPER RINGING AND TALKING.~~							
7	INSPECT VACUUM TUBES FOR ~~LIGHTED FILAMENTS AND~~ SECURE MOUNTING. *(Amplifier type)* PAR. 17 b		✓					

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
8	INSPECT CORDS FOR KINKS, FRAYING, CUTS, BREAKS. ~~(Indoor use).~~	✓	14	~~INSPECT HANDSET FOR CHIPS, CRACKS, LOOSE CAPS OR CAPSULES, DIRT, GREASE, MOISTURE.~~	
9	INSPECT EXTERIOR CONNECTIONS FOR SNUG FIT AND GOOD CONTACT. ~~(Indoor use).~~	✓	15	INSPECT SNAP FASTENER ON CASE. *(Outdoor use).*	✓
10	CLEAN CORDS, BATTERY COMPARTMENT, EXTERIOR OF CASE, ~~HOUSING, DIAL, HANDSET. (Indoor use).~~	✓	16	INSPECT LEATHER ~~AND CANVAS~~ ITEMS FOR MILDEW, TEARS AND FRAYING.	✓
11	INSPECT EXTERIOR FOR CHIPS, CRACKS, CORROSION, RUST, MOISTURE, MILDEW, DIRT, GREASE, ~~BROKEN OR MISSING GENERATOR HANDLE.~~	✓	17	INSPECT ~~TELEPHONE~~ SET FOR COMPLETENESS - CORDS, ~~DIALS, HANDSET,~~ BATTERIES, ~~GENERATORS,~~ TUBES, CARRYING CASES, ACCESSORIES, ~~TECHNICAL MANUALS,~~ RUNNING SPARE PARTS.	✓
12	TIGHTEN LOOSE ASSEMBLY AND MOUNTING HARDWARE.	✓	18	~~INSPECT FOR PROPER INSTALLATION IN COOL, DRY PLACE.~~	
13	INSPECT MARKINGS FOR LEGIBILITY, ~~CORROSION.~~	✓			

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-240 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 2157-6

Figure 6. DA Form 11–240.

18. Battery Replacement

Replace the batteries when the output from the amplifier has gradually decreased so that it is difficult to distinguish between the tone and background noise.

a. Remove the amplifier from the case and remove the defective batteries.

b. Install new batteries (par. 11*a*) and replace the amplifier in the case (par. 11*c*).

c. Check the operation of the amplifier (par. 11*d*) to be sure the new batteries are in good condition.

Section II. ORGANIZATIONAL MAINTENANCE PROCEDURES

19. Scope of Organizational Maintenance

a. Following is a list of maintenance duties normally performed by the organizational maintenance personnel. These duties are limited by the available spare parts, tools, materials, and test equipment.

b. Organizational maintenance for Telephone Test Set AN/PTM–5 consists of preventive maintenance (par. 21) and replacement of tubes (par. 22).

20. Tools and Materials

a. Tools.

(1) Screwdriver TL–360/U.
(2) Friction Tape TL–636/U.
(3) Long nose pliers.
(4) Diagonal pliers.
(5) Electrician's knife.
(6) Wrench set (Spintite).
(7) Screwdriver (Phillips).
(8) Soldering Iron TL–117.
(9) Solder (resin core).

b. Materials. The materials required to perform organizational maintenance are the same as those listed for the operator (par. 16).

21. Organizational Preventive Maintenance

a. Use of DA Form 11–241 (fig. 7). DA Form 11–241 is a preventive maintenance checklist to be used by organizational maintenance personnel. Items not applicable are marked out in the figure. References in the ITEM block of the figure are to paragraphs that contain additional maintenance information pertinent to that particular item. Instructions for the use of the form appear on the back of the form.

b. Items. The information shown in this paragraph is supplementary to DA Form 11–241. The item numbers correspond to the ITEM numbers on the form.

Item	Maintenance procedures
21	Check each connection to be sure that they are not loose or broken. Reconnect and resolder all loose connections.
25	Check the PROBE-COIL switch to be sure it operates properly. Check the VOL control to be sure it operates easily and smoothly.

22. Replacement of Tubes

(fig. 8)

If the amplifier fails to operate properly after new batteries have been installed and the wiring has been checked for loose or broken connections, check for defective tubes by using the tube substitution method.

a. Tube Substitution. The tube substitution method of testing consists of replacing a suspected tube with a new tube. If the amplifier remains inoperative, remove the new tube and replace the original tube. Repeat this procedure with each suspected tube until the defective tube is located.

b. Tube Removal.

(1) Remove the amplifier from the case.
(2) Remove the tube clamping bar.
(3) Push the tube toward the front panel with the thumb nail placed against the bulge of the glass.

Caution: Do not bend, twist, or turn the tube while it is in the socket.

c. Tube Installation.

(1) Check the new tube to be sure the pins have been trimmed to ¼ inch long. If they have not been trimmed, clip the pins off with sidecutting pliers.
(2) Aline the red dot on the side of the tube with the red dot on the socket.
(3) Check to be sure the pins are alined with the holes in the tube socket.
(4) Push the pins into the tube socket by pressing on the top of the tube.

Caution: Hold the tube socket with one hand while pressing the tube into the socket with the other.

(5) Check the amplifier as explained in paragraph 11*d* to be sure the trouble has been corrected.
(6) Replace the tube clamping bar and replace the amplifier in the case.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
TELEPHONE SET

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: *TELEPHONE TEST SET AN/PTM-5*

EQUIPMENT SERIAL NO.:

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
1	INSPECT CORDS FOR KINKS, FRAYING, CUTS, BREAKS. *(Outdoor use).*	✓	17	INSPECT ~~TELEPHONE~~ SET FOR COMPLETENESS - CORDS, ~~DIALS, HANDSET,~~ BATTERIES, ~~GENERATORS,~~ TUBES, CARRYING CASES, ACCESSORIES, ~~TECHNICAL MANUALS,~~ RUNNING SPARE PARTS.	✓
2	INSPECT EXTERIOR CONNECTIONS FOR SNUG FIT AND GOOD CONTACT. *(Outdoor use).*	✓	18	~~INSPECT FOR PROPER INSTALLATION IN COOL, DRY PLACE.~~	
3	CLEAN CORDS, CASES, ~~HANDSET,~~ AND BATTERY COMPARTMENT OF MOISTURE, DIRT, GRIME, ~~BATTERY ACID,~~ MILDEW, CORROSION. *(Outdoor use).*	✓	19	~~INSPECT CORDS AND LINE TERMINALS FOR FRAYING, BREAKS, CUTS, PROPER CONNECTIONS FOR CB OR LB OPERATION.~~	
4	INSPECT FOR SECURE MOUNTING STRAPS. *(Outdoor use).*	✓	20	CLEAN INTERIORS OF ~~TELEPHONE~~ HOUSINGS, CHASSIS, CARRYING CASES, BATTERY COMPARTMENTS OF ALL CORROSION, MOISTURE, MILDEW, RUST, EXCESS SOLDER, DIRT, GRIME, GREASE.	✓
5	INSPECT BATTERY COMPARTMENT FOR CORROSION, GOOD BATTERIES, BROKEN OR MISSING SPRINGS, ~~BATTERY ACID. (Local battery sets).~~	✓	21	INSPECT INTERIOR WIRING AND CONNECTIONS FOR GOOD CONTACT, BREAKS, CUTS, FRAYING. PAR. 21	✓
6	~~OPERATE THE TELEPHONE AND CHECK FOR PROPER RINGING AND TALKING.~~		22	~~INSPECT GENERATOR FOR WORN OR CHIPPED GEARS, LOOSE SCREWS, WORN RUBBER, BROKEN CONTACT SPRINGS. (Local battery sets).~~	
7	INSPECT VACUUM TUBES FOR ~~LIGHTED FILAMENTS AND~~ SECURE MOUNTING. *(Amplifier type).*	(X)	23	~~BURNISH GENERATOR CONTACTS AND ADJUST SPRINGS. (Local battery sets).~~	
8	~~INSPECT CORDS FOR KINKS, FRAYING, CUTS, BREAKS. (Indoor use).~~		24	~~TIGHTEN ALL LOOSE ASSEMBLY AND MOUNTING SCREWS.~~	
9	~~INSPECT EXTERIOR CONNECTIONS FOR SNUG FIT AND GOOD CONTACT. (Indoor use).~~		25	INSPECT ~~HOOK SWITCHES, CANDLE SWITCHES, HANDSET BUTTERFLY SWITCH AND~~ CONTROL SWITCHES FOR POSITIVE ACTION AND GOOD CONTACT. PAR. 21	✓
10	~~CLEAN CORDS, BATTERY COMPARTMENT, EXTERIOR OF CASE, HOUSING, DIAL, HANDSET. (Indoor use).~~		26	INSPECT VACUUM TUBES FOR SECURE MOUNTING, VISIBLE DAMAGE, ~~AND LIGHTED FILAMENT.~~ *(Amplifier type).*	✓
11	INSPECT EXTERIOR FOR CHIPS, CRACKS, CORROSION, RUST, MOISTURE, MILDEW, DIRT, GREASE, ~~BROKEN OR MISSING GENERATOR HANDLE.~~	✓	27	INSPECT PLUGS AND JACKS FOR SNUG FIT AND GOOD CONTACT.	✓
12	TIGHTEN LOOSE ASSEMBLY AND MOUNTING HARDWARE.	✓	28	CLEAN PLUGS AND JACKS OF RUST, MOISTURE, DIRT, GRIME, AND GREASE.	✓
13	INSPECT MARKINGS FOR LEGIBILITY, ~~CORROSION.~~	✓	29	~~INSPECT RELAYS FOR POSITIVE ACTION AND GOOD CONTACT.~~	
14	~~INSPECT HANDSET FOR CHIPS, CRACKS, LOOSE CAPS OR CAPSULES, DIRT, GREASE, MOISTURE.~~		30	~~CLEAN SWITCHES AND RELAYS OF DIRT, DUST AND MOISTURE.~~	
15	INSPECT SNAP FASTENER ON CASE. *(Outdoor use).*	✓	31	~~CLEAN AND TIGHTEN ALL TERMINAL CONNECTIONS.~~	
16	INSPECT LEATHER ~~AND CANVAS~~ ITEMS FOR MILDEW, TEARS, AND FRAYING.	✓	32	~~LUBRICATE THE EQUIPMENT USING THE LATEST DEPARTMENT OF THE ARMY LUBRICATION ORDER.~~	
			33	~~INSPECT THE TELEPHONE SET FOR PROPER MOISTURE AND FUNGUS PROOFING.~~	
34	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.				

DA FORM 1 MAY 51 11-241 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE. 00—10—64382-1

TM 2157-7

Figure 7. DA Form 11–241.

CHAPTER 4
THEORY

23. Battery Supply Circuits (fig. 12)

When the test set is connected for operation the probe plug or exploring coil plug is inserted into INPUT jack J2 and the receiver plug is inserted into REC jack J1. Contacts 2–3 on jack J1 close connecting the B+ supply (B1 22½ volts) to the plate and screen grid of each tube; contacts 5–6 close connecting the filament supply (B2 1½ volts) to each tube.

a. Plate and Grid Battery Supply.

(1) B+ is supplied to the plate of tube V1 through contacts 3–2 of jack J1, terminal 5 of the terminal board, the 700-kilohm resistor, and a 2-megohm resistor. It is supplied to tube V2 from contact 2 of jack J1 through terminal 5 of the terminal board and a 2-megohm resistor and to tube V3 from contact 2 of jack J1, through the 4–6 winding of transformer T1 and terminal 4 of the terminal board.

(2) B+ is supplied to the screen grid of tube V1 from contact 2 of jack J1 through terminal 5 of the terminal board, the 700-kilohm resistor and a 5.6-megohm resistor. It is supplied to the screen grid of tube V2 from contact 2 of jack J1 through terminal 5 of the terminal board and a 5.6-megohm resistor, and to the screen grid of tube V3 directly from contact 2 of jack J1 through terminal 5 of the terminal board.

b. Filament Battery Supply. Contacts 5–6 of jack J1 close connecting the negative side of B2 through terminal 8 of the terminal board, and series connected filaments of tubes V1 and V2, and terminal 2 of the terminal board to the positive side of battery B2. The filament of tube V3 is in parallel with the filaments of tubes V1 and V2 and is connected to terminals 2 and 8 of the terminal board.

24. Input Circuit and Input Amplifier Stage (fig. 12)

a. Input Circuit. A signal picked up by a probe or an exploring coil is applied to the tip and sleeve of jack J2. The sleeve of jack J2 and contact 2 of switch D1 is conected to ground.

(1) When switch D1 is in the PROBE position, the signal

path is from the tip contact of jack J1 through the 3–1 winding of transformer T2, the float contact and contact 1 of switch D1, through capacitor C1 to terminals 10 and 9 of the terminal board.

(2) When switch D1 is in the COIL position the signal path is from the tip contact of jack J1 through the 3–1 winding of transformer T2, the float contact and contact 2 of switch D1 to the sleeve of jack J2. The signal is induced from the 1–3 winding of transformer T2 into the 4–6 winding of transformer T2. Capacitor C3 tunes the 4–6 winding of transformer T2 to approximately 500 cps. The signal path to the terminal board is the same as described in (1) above.

b. Input Amplifier Stage. The input signal applied from terminals 10–9 of the terminal board develops a voltage to ground across grid resistor R1. This voltage is applied to the control grid of input amplifier V1. The output signal from tube V1 is developed across the 2-megohm plate load resistor and is coupled to tube V2 through a 1,000 $\mu\mu$f coupling capacitor and 1–3 of VOL potentiometer P1. The 5.6-megohm resistor and the 5,000 $\mu\mu$f capacitor serve as screen grid voltage dropping resistor and the screen grid bypass capacitor. The 700 kilohm resistor and .04 μf capacitor provide a decoupling network for the input amplifier.

25. Interstage Amplifier

(fig. 12)

Signal voltage from contact 3 of VOL potentiometer P1 is applied to the control grid of tube V2. The VOL potentiometer controls the overall gain of the amplifier by controlling the input signal applied to tube V2. The output voltage is developed across a 2-megohm plate load resistor and is coupled to tube V3 through a 1,000 $\mu\mu$f coupling capacitor. The 5.6-megohm resistor and the 5,000 $\mu\mu$f capacitor serve as a screen grid voltage dropping resistor and the screen grid bypass capacitor.

26. Output Amplifier Stage

(fig. 12)

Signal voltage from the 1,000 $\mu\mu$f coupling capacitor is applied to the control grid of power amplifier tube V3. The 10-megohm resistor is the grid resistor for V3. The output voltage from tube V3 is developed across the 6–4 winding of transformer T1. A voltage induced from the 6–4 winding into the 1–3 winding of transformer T1 causes the signal to be applied to contacts 1–4 of jack J1, through the tip and ring of the receiver plug to the receiver. Capacitor C3 tunes the 4–6 winding of transformer T1 to approximately 500 cps.

CHAPTER 5
FIELD MAINTENANCE

Section I. GENERAL TROUBLESHOOTING INFORMATION

27. General Instructions

Troubleshooting at field and depot maintenance level includes all of the techniques outlined for organizational maintenance and any special or additional techniques required to isolate a defective part. The field and depot maintenance procedures are not complete within themselves, but supplement the procedure described in organizational maintenance. The systematic troubleshooting procedure, which begins with the operational and sectionalization checks usually performed at organizational level, must be completed by means of further localizing and isolating techniques.

28. Troubleshooting Procedures

a. General. The first step in servicing a defective test set is to sectionalize the fault. Sectionalization means tracing the fault to the circuit responsible for the fault. The second step is to localize the fault by tracing it to the specific part responsible for the abnormal operation. Faults such as burned resistors or discolored capacitors can often be located by inspection. The majority of faults, however, must be localized by checking voltages and resistances.

b. Component Sectionalization and Localization. The steps listed below simplify repair and reduce unnecessary work in tracing trouble to a specific component. Follow the procedure in the sequence given.

(1) *Inspection.* The purpose of the inspection is to locate faults without testing or measuring circuits. All connections and components should be observed to localize the fault to a particular circuit.

(2) *Operational test.* The operational test of the amplifier (par. 11) will frequently indicate the general location of the fault.

(3) *Troubleshooting chart.* The troubles listed in the troubleshooting chart (par. 31) aid in sectionalizing and localizing trouble.

(4) *Voltage and resistance diagram.* Measurement of voltage and resistance at various points in the circuit often localizes a fault.

(5) *Intermittents.* Check the test set for intermittent trouble by tapping or jarring it during the operational test ((2) above). Move the wires in the test set with an insulated tool to check for loose or poorly soldered connections.

29. Tools

The tools required to repair the test set are listed below.

Cleaning tool WECo 497A.
Cord Cutter WECo 312B.
Electrician's knife.
Screwdriver.
Screwdriver KS–2348.
Soldering iron.
Diagonal pliers (notched).
Long-nosed pliers.
Pliers WECo 234 or 235.

30. Test Equipment

The test equipment required to troubleshoot the test set is listed in the chart below. The chart also lists the technical manual associated with each test set and the common name used in this manual.

Test equipment	Technical manual	Common name
Signal Generator (Audio) TS–382A/U	TM 11–2684A	Audio oscillator
Multimeter TS–352( )/U (or equivalent)	TM 11–5527	Multimeter
Electron Tube Test Set TV–7( )/U	TM 11–5083	Tube tester
Test Set I–42–( ) or Telephone Test Set AN/PTM–6.	TM 11–2062	
Electronic Multimeter TS–505( )/U	TM 11–5511	Vtvm

Section II. TROUBLESHOOTING AND REPAIR

31. Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in the test set. The chart lists the symptoms which the repairman observes during operation, the probable trouble, and the corrective action to be taken. After the trouble has been localized to a particular circuit, a tube check and voltage and resistance measurements of this circuit should isolate the trouble to the defective part. Normal voltage and resistance readings are given in figure 10.

Symptom	Probable trouble	Corrective action
1. No output.	VOL control set too low.	Turn VOL control clockwise.
	Low battery voltage.	Measure battery voltage using Multimeter TS-352( )/U; replace defective battery.
	Open or shorted receiver, receiver cord, or receiver plug.	Perform continuity check using Multimeter TS-352( )/U; repair or replace defective part.
	Open or shorted probe tool, probe tool cord, or probe tool plug.	Peform continuity check using Multimeter TS-352( )/U; repair or replace defective part.
	Defective tube.	Test and replace defective tube.
	Defective printed circuit network.	Perform voltage and resistance checks (fig. 10). Electronic Multimeter TS-505( )/U; replace network (par. 33*a*).
2. Weak output.	VOL control set too low.	Turn VOL control clockwise.
	PROBE-COIL switch in wrong position.	Set switch to correct position.
	Low battery voltage.	Measure battery voltage using Multimeter TS-352( )/U; repair or weak battery.
	Defective tube.	Test and replace defective tube.
	Open or shorted probe tool, probe tool cord, or probe tool plug.	Perform continuity check using Multimeter TS-352( )/U repair or replace defective part.
	Defective printed circuit network.	Perform voltage and resistance check (fig. 10) using Electronic Multimeter TS-505( )/U; replace network (par. 33*a*).
3. Noise when amplifier is moved or bumped.	Microphonic tube.	Locate by tapping tubes gently. Replace microphonic tube.
	Intermittent.	Locate (par. 28*b*(5)) and repair defect.
4. Noise when VOL control is moved.	Defective VOL control.	Replace control (par. 33*b*).

32. Additional Troubleshooting Information

a. Voltage Measurements. The following chart lists the voltages that can be checked with a 20,000 ohms-per-volt voltmeter (Multimeter T5–352( )/U) when the receiver plug has been inserted into the REC jack.

Voltmeter connections		Voltage reading (volts dc)
— lead	+ lead	
2	8	—1 to 1½
2	4	17 to 22½
2	5	17 to 22½

b. Transformer Winding Resistance. The resistance of the windings of transformers T1 and T2 are the same. The following chart lists the windings and the resistance.

Winding	Resistance (ohms)
1–3	5
4–6	1,200

c. Illustrations. The following chart lists the illustrations that are provided to assist the repairman in locating troubles and repairing the equipment.

Title	Figure No.
Amplifier, top view with tube clamping bar removed.	8
Amplifier, bottom view.	9
Voltage and resistance diagram.	10
Amplifier, schematic diagram.	12
Amplifier, wiring diagram.	13

33. Repair and Replacement of Parts

a. Printed Circuit Network (fig. 8).

(1) Remove the amplifier from the case.

(2) Remove the tube clamping bar.

(3) Carefully remove the tubes from the sockets. Note the position of the tubes so that they can be replaced in the proper sockets during reassembly.

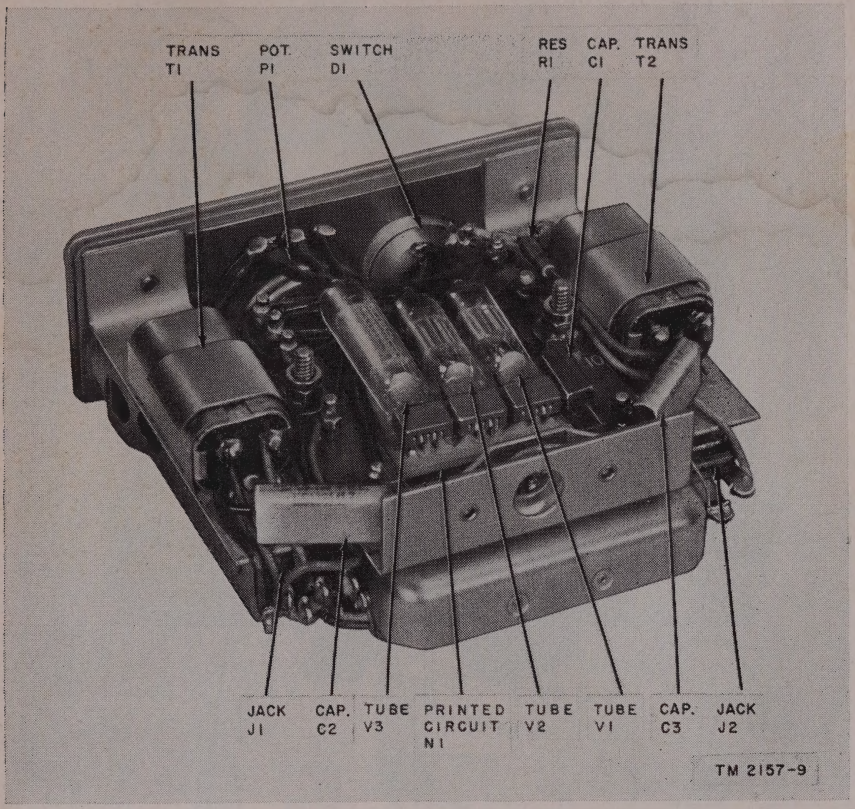


Figure 8. Amplifier, top view, with tube clamping bar removed.

(4) Disconnect the network leads from the terminals on the terminal strips.

(5) Remove the network from the amplifier and slide the insulating sleeving from the network leads. Save the sleeving so that it can be used on the new network.

(6) Place a new network face-to-back with the defective network and cut the leads on the new network to the same length as the leads on the defective network.

(7) Slide the insulating sleeving on the network leads and position the new network in the amplifier.

(8) Connect and solder the network leads to the terminals on the terminal boards (fig. 13).

(9) Replace the tubes. Check the notes made during disassembly to be sure they are replaced in the proper sockets. Be sure the red dots on the tube are alined with the red dots on the tube sockets.

(10) Replace the tube clamping bar and replace the amplifier in the case.

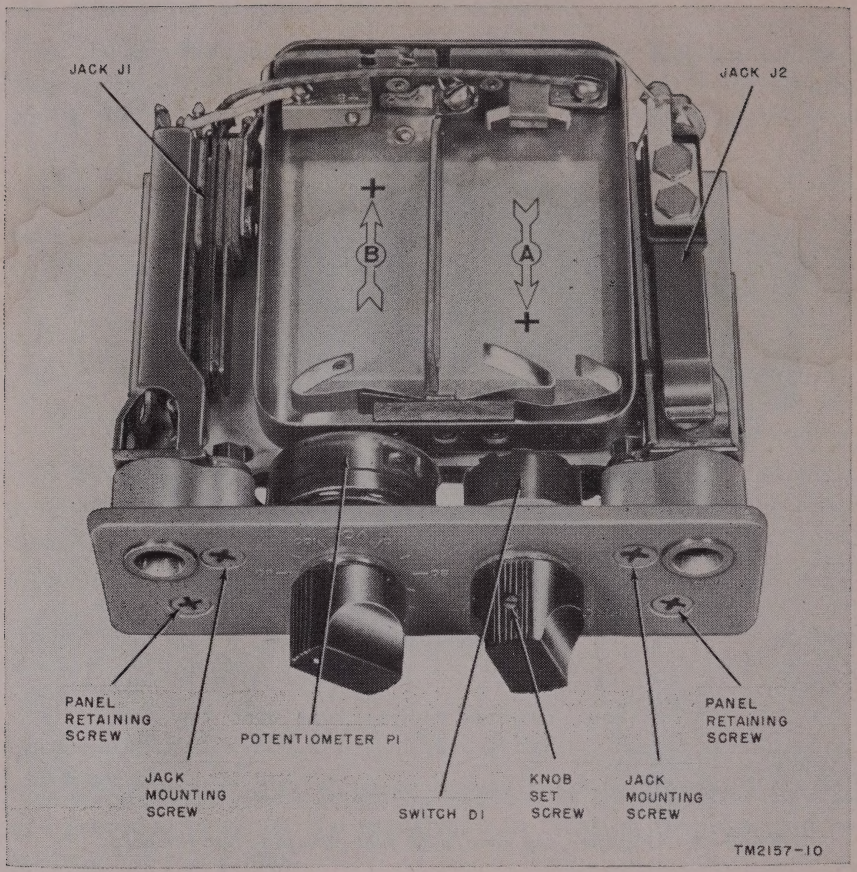


Figure 9. Amplifier, bottom view.

b. Potentiometer P1 and Switch D1.

(1) Remove the amplifier from the case.
(2) Remove the knob from the defective component.
(3) Remove the panel retaining screws (fig. 9).
(4) Remove the jack mounting screws, nuts, and washers from jacks J1 and J2.
(5) Remove the front panel from the amplifier.
(6) Disconnect the lead from the defective component. Note the position of each lead. Remove the defective component.
(7) Place the new component in position and connect the leads. Be sure to check the position of each lead (fig. 13).
(8) Replace the front panel on the amplifier.
(9) Replace the jack mounting screws, washers, and nuts.
(10) Replace the panel retaining screws.
(11) Replace the amplifier in the case.

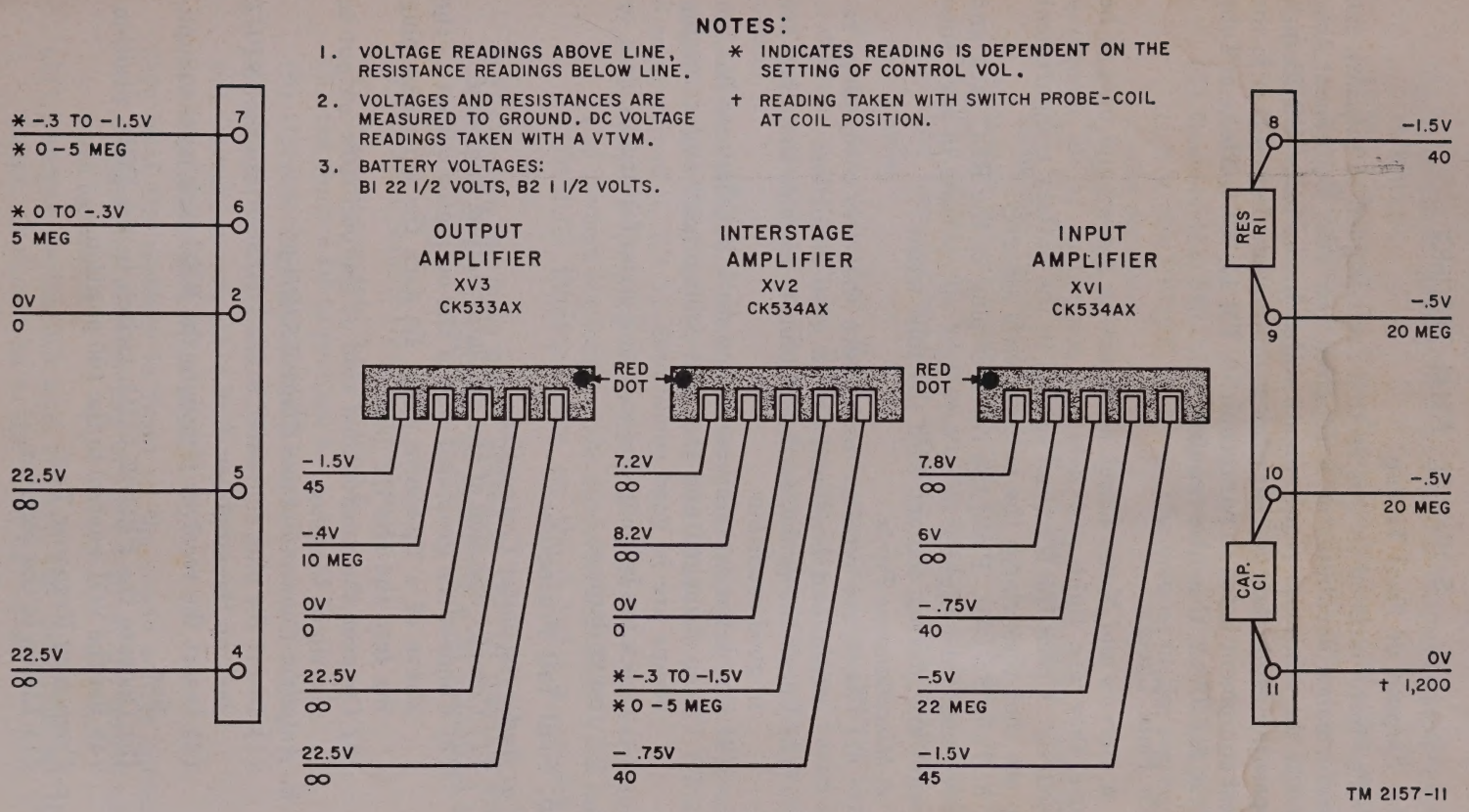


Figure 10. Voltage and resistance diagram.

Section III. FINAL TESTING

34. Purpose of Final Testing

The tests outlined in this section are designed to measure the performance capability of a repaired test set. Equipment that meets the minimum requirements stated in the tests will furnish operation equivalent to that of new equipment. In addition to the test equipment listed in paragraph 30, TM 11–2661, Electron Tube Test Set TV–2/U is also required.

35. Final Checks

a. Screws and Nuts. Check all retaining screws and nuts to be sure they are tight and hold the component to its mounting securely. Check the terminal screws in the battery compartment to see that they clamp the battery leads securely.

b. Tube Sockets. Place the receiver plug in the REC jack and move each tube slightly to be sure that all contacts in each tube socket are making contact with the tube wires.

c. Miscellaneous Parts.

(1) Check the receiver to be sure that the cord, plug, receiver, and headband are in good condition.

(2) Check the probe, cord, and plug to be sure that they are in good condition.

(3) Check the carrying case to be sure that the case has not been damaged and that the rubber pads and retaining straps are in good condition.

(4) Check the belt clip and carrying strap for cracks, cuts, or other damage.

36. Final Test Procedures

a. Audio Oscillator Connections.

(1) Connect one side of the oscillator output to ground.

(2) Connect the grounded side of the oscillator output to the sleeve of a tip-sleeve plug. Be sure the tip-sleeve plug fits into the INPUT jack.

(3) Connect the ungrounded side of the oscillator output to the tip of the plug.

b. Amplifier Connections and Control Settings.

(1) Insert the plug connected to the oscillator into the INPUT jack on the amplifier.

(2) Insert the receiver plug into the REC jack on the amplifier.

(3) Operate the PROBE-COIL switch to the COIL position.

(4) Set the VOL control to the 100 position.

c. Frequency Response Test.

(1) Listen to the receiver.

(2) Vary the frequency of the oscillator output from 300 cps to 800 cps.

(3) The volume of the tone should be loudest when the oscillator frequency is between 440 and 550 cps.

d. PROBE-COIL Switch Test.

(1) Set the oscillator frequency to the maximum response (about 500 cps).

(2) Operate the PROBE-COIL switch from the COIL position to the PROBE position. The volume in the receiver should decrease.

e. VOL Control Test.

(1) Set the oscillator frequency to the maximum response frequency (about 500 cps).

(2) Rotate the VOL control from 100 to 0 and back to 100.

(3) The volume of the tone in the receiver should decrease and increase smoothly without any sudden changes or noise.

f. Amplifier Noise Test. Remove the plug from the INPUT jack and listen to the receiver. A background hiss should be heard in the receiver but should not be loud enough to interfere with a weak signal.

g. Headset H–147/U Test. Perform the following test to check the efficiency of the test receiver. Use the I–142–( ) or AN/PTM–6 as explained in TM 11–2062.

(1) Remove the plug from the end of the test receiver cord and connect the leads of the cord to the RECEIVER and COMMON binding posts on the I–142–( ) or AN/PTM–6.

(2) Operate the main power switch to the ON position and calibrate the I–142–( ) or AN/PTM–6 as explained in TM 11–2062.

(3) Operate control D2 to position 2.

(4) Operate control D4 to position 6.

(5) Set control D5 to position 1.

(6) Operate the EQUALIZER to OUT.

(7) Operate switch K1 to CBPE.

(8) Operate switch K2 to RCT.

(9) Operate switch K8 to REC.

(10) Hold the receiver in front of the sound source screen; position the receiver cap in the center of the screen and flush against it.

(11) Depress switch K9 and observe the deflection on the meter. It should be to the right of —2 db.

CHAPTER 6
SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

37. Repacking

a. Preparation.

(1) Remove the batteries from the amplifier.

(2) Remove the spare batteries from the carrying case.

(3) Check the components of the test set against the table of components (par. 5) to be sure that none are missing.

(4) Clean each component thoroughly.

b. Placing Components in Carrying Case (fig. 11).

(1) Snap the belt clip on the amplifier.

(2) Strap the amplifier against the cushioning pads in the carrying case. Be sure that the strap is tight.

(3) Place the receiver, carrying strap, and probe in the carrying case.

(4) Fill the carrying case with crumpled paper, excelsior, or other packing material.

(5) Close the carrying case cover and lock it with the snap fastener.

c. Packing. Use a corrugated shipping carton similar to the one shown in figure 2 and pack the test set by reversing the procedures given in paragraph 8.

38. Authority for Demolition

Demolition of the test set will be accomplished only upon order of the commander. The destruction procedures outlined in paragraph 39 will be used to prevent further use of the test set.

39. Methods of Destruction

a. Smash. Smash the controls, tubes, switch, capacitors, transformers, case, resistors, jacks, probe, receiver, plugs, front panel, and printed circuit network; use sledges, axes, handaxes, hammers, crowbars, or other heavy tools.

b. Cut. Cut the cords, carrying strap, belt clip, and wire leads; use axes, handaxes, or machetes.

c. Burn. Burn cords and technical manuals; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Disposal. Bury or scatter the destroyed parts in slit trenches, foxholes, or throw them into streams.

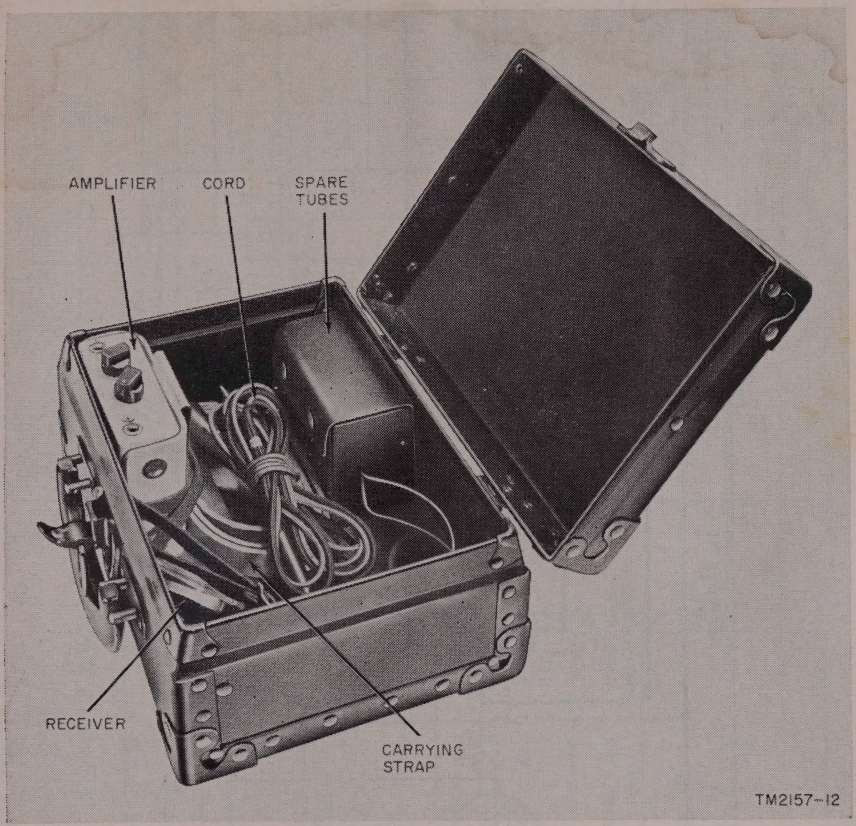


Figure 11. Telephone Test Set AN/PTM–5, packed in carrying case.

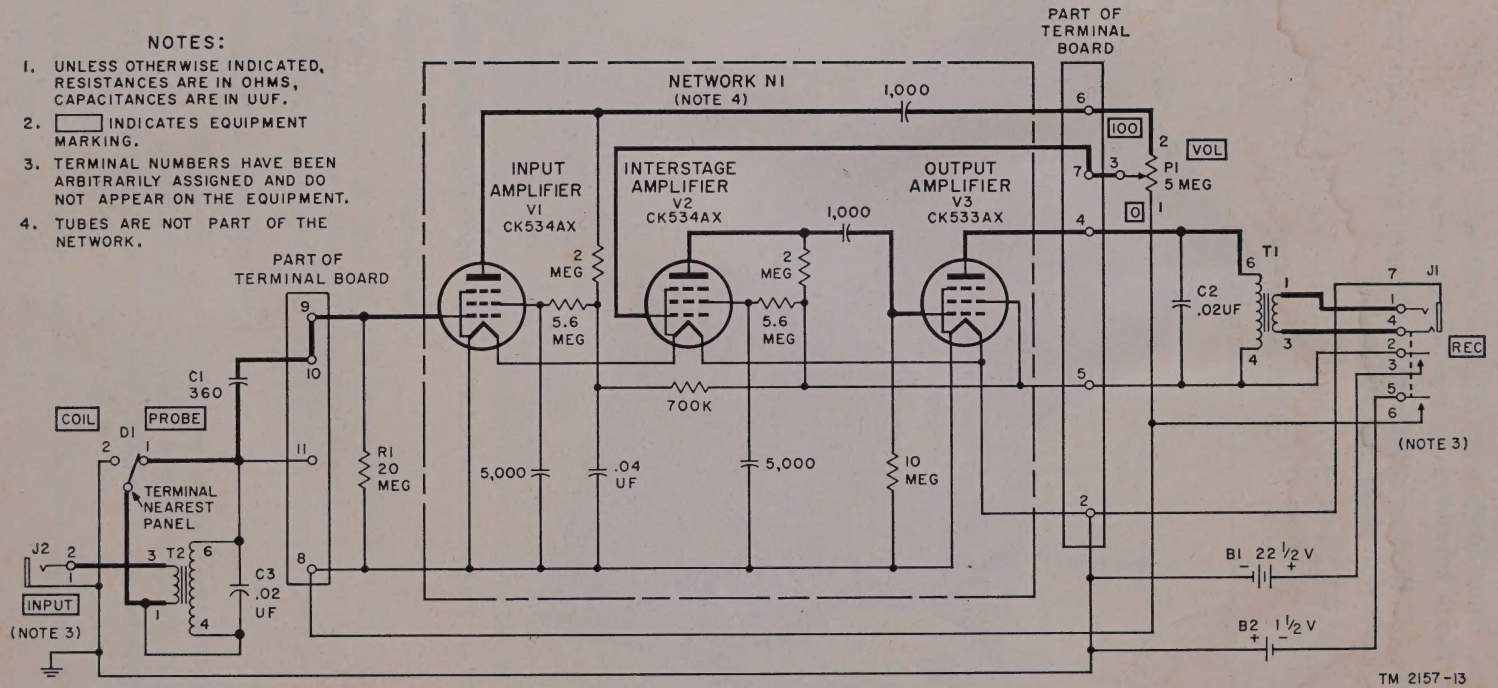
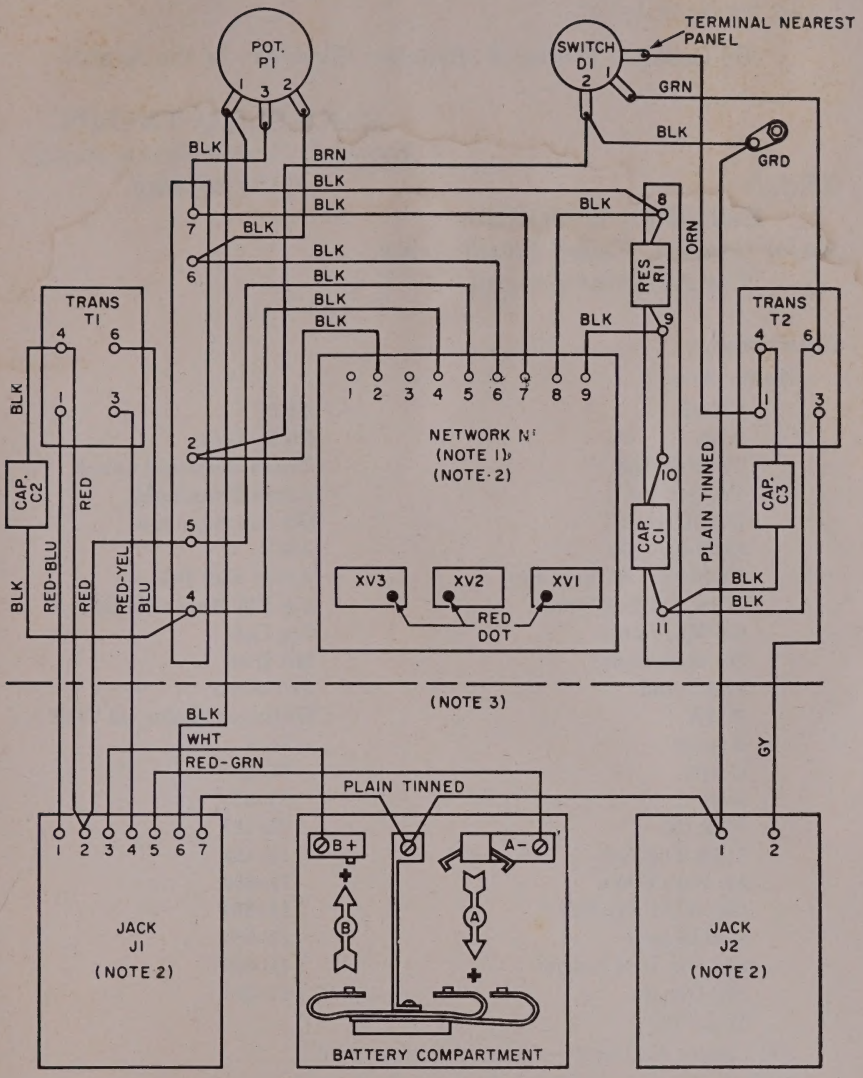


Figure 12. Amplifier, schematic diagram.



NOTES:

1. THIS IS A PRINTED CIRCUIT NETWORK. WIRING AND COMPONENTS WITHIN THE NETWORK (EXCEPT TUBE SOCKETS) ARE NOT SHOWN.
2. TERMINAL NUMBERS HAVE BEEN ARBITRARILY ASSIGNED AND DO NOT APPEAR ON THE EQUIPMENT.
3. COMPONENTS BELOW THE DASHED LINE ARE MOUNTED ON THE UNDERSIDE OF THE CHASSIS.

TM 2157-14

Figure 13. Amplifier, wiring diagram.

[AG 413.42 (26 Apr 57)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

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Chief of Staff.

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OS Maj Comd	Sig Lab
OS Base Comd	Mil Dist
Log Comd	JBUSMC
MDW	Units org under fol TOE:
Armies	11–7
Corps	11–16
Div	11–57
Ft & Cp	11–127
USA Tng Cen	11–128
Sp Wpn Comd	11–500
Gen & Br Svc Sch	11–557
Gen Depots	11–587
Sig Sec, Gen Depots	11–592
Sig Depots	11–597
WRAMC	

NG: State AG; units—same as Active Army.

USAR: None.

For explanation of abbreviations used, see SR 320–50–1.

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